

SOME OF THE ELEMENTS OF SUCCESS IN CŒLIOTOMY.¹

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Although abdominal sections have, on the one hand, been performed much too often, and sometimes when there has been no organic disease of the viscera, yet on the other hand they have not been performed often enough when there has been a real necessity for removing accumulations of virulent pus in the ovaries or tubes, so that while the mania for removing healthy appendages by inexperienced operators is passing away, the courage of experienced abdominal surgeons is gradually increasing, and cases which the boldest would have hesitated to touch a few years ago are now operated upon by the skilled gynecologist with complete success. Increasing success has encouraged us to greater boldness, and the greater boldness has itself in turn greatly increased our success. It is well from time to time to take stock of our progress, and I have therefore chosen a review of the elements of our present success in abdominal surgery for the subject of my contribution. In coming to my conclusions, I have adopted two methods, the one consisting in inquiring among a great number of honest and skillful operators whether they have ever had any deaths, and if so, what was the cause of death, and how could it have been prevented; and secondly, I have observed closely the methods of a great number of successful operators whose death-rate had reached the minimum figure, and I believe that it was easy to see why they were successful. My own experience has been too small to deserve great consideration, but my own three deaths have not been without teaching me valuable lessons which I shall incorporate in this paper. From the above inquiries I found that death following abdominal section is due to one or more of the following causes, which I have placed in the order of their frequency, namely:

First.—Sepsis or peritonitis.

Second.—Hemorrhage, either immediate (otherwise called shock) or secondary.

Third.—Prolonged anesthesia.

Fourth.—Interference with the peristalsis of the bowels.

Fifth.—Procrastination of the operation.

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In addition to these causes, which are matters of life and death, there are other minor accidents, such as mural abscesses, ventral hernia and wounds of the bladder, which, while not dangerous to life, yet destroy more or less the success of the operation.

The Avoidance of Sepsis or Peritonitis.—Provided that absolute surgical cleanliness can be obtained in everything pertaining to the patient, the operator and his instruments, including ligatures and sutures, we have little or nothing to fear from sepsis. It is a mistake to think that a costly operating room is absolutely essential. I have frequently successfully performed coeliotomy in the homes of the very poor, situated in the most unsanitary district of Montreal, while many of my most difficult operations have been performed in a small operating room at the Women's Hospital, where other operations are performed, including the curetting of foul puerperal fever cases, and yet case after case has made an uninterrupted recovery without evincing the slightest sign of sepsis. On several occasions my assistant has been a general practitioner in active practice, who was at the time attending cases of diphtheria and scarlet fever, while there have nearly always been present as spectators many general practitioners and students. Provided that the rule be strictly observed that no one be allowed to touch anything used during the operation, except those whose hands have been properly prepared, I would care very little whether or not the visitors had been attending puerperal fever or diphtheria just before coming to the operation. So that we may safely say that much of the elaborate preparation of visitors carried out at the German clinics, such as putting on hospital suits or removing their collars and neckties and spraying them with carbolized steam is quite unnecessary, provided that the visitors can be placed where it will be impossible for them to get at or touch anything to be used during the operation; no other precautions regarding them are necessary, but this precaution is an absolute necessity. It is an axiom of mechanics that no piece of machinery is stronger than its weakest part, and all the elaborate attention to the details of asepsis are of no avail if one visitor who is not aseptic can get a chance to infect our instruments or sponges. I can hardly count the number of times I have seen a visitor try to pick up a knife or forceps or sponge that has fallen on the ground, and replace it on the tray or dish; and once I saw the practitioner who had sent the case to a leading New York operator, who was performing a difficult abdominal operation under the most elaborate aseptic precautions, walk in during the operation, and without even washing his hands, suddenly attempt to assist the operator by holding in the intestines. At other times they will slip in before the operator and handle the carefully sterilized ligatures or sponges. The notices seen in many hospitals, warning visitors not to touch anything, are a good precaution, but it is not sufficient. It would be better to rail

them off, so that they cannot possibly get at the sterilized materials. So much for the visitors; I hope I have not been too hard on them, but they always make me anxious for the success of my operation.

The nurses as well as the assistants must, of course, have their hands disinfected immediately before the operation just as thoroughly as the operator, for although their hands do not go into the peritoneal cavity, yet the sponges directly from their hands do so. I, therefore, see this done by the assistants and nurses and never accept their statement that their hands are clean; whatever precautions I take, they must take at the same time. They must scrub their nails with soap and hot water, rinse them in bichloride, then in water; then they must steep them in saturated permanganate of potash solution, until they are mahogany brown, and then whiten them in oxalic solution, and then rinse them in boiled water, but I do not ask them if they are menstruating, as does some over-zealous brother, whose name I forget. I do not think that this makes any difference.

During the years that I used sponges, their proper disinfection caused me much anxiety, besides being so destructive to their delicate organism as to put me to considerable expense. I have now done away with them entirely in my private hospital, and hope soon to do the same at the Women's Hospital. My nurses now make for me, in their spare time, hundreds of square six-inch pads of absorbent gauze, sewed together at their edges, six layers thick, which they sublimate and afterwards boil for several hours. By this process they are rendered absolutely sterile, nor are they thrown away when once used; on the contrary, after the operation they are boiled for an hour in solution of washing soda, which dissolves all the fibrin out of them, and they are then dried in an oven at 212° , from which they are at once removed to a glass-stoppered jar until they are absolutely sterile, then they are wrapped up in a towel with the instruments and ligatures, and again boiled for half an hour before the next operation. This towel is only unfolded by the operator himself at the moment of commencing the operation; no antiseptics of any kind are used about the instruments. Carbolic acid 1 to 40 solution is not as good as boiling water for disinfecting, while a 1 to 20 solution is most destructive to the hands. Carbolic acid is useless, costly, and unpleasant; the first reason alone being sufficient to make us discard it. A teaspoonful of washing soda in a pail of water in which the instruments are boiled prevents the steel ones from being rusted; the knives are wrapped in one of the aforesaid gauze-pads in order to protect the edges, but frequent heating and gradual cooling of steel cutting instruments anneals them or softens their temper, but this can be restored by alternately dipping them into boiling, and ice water for a few times. The silkworm gut, which I invariably use for the abdominal sutures, and the silk ligatures, which I have so far used for the pedicle, are boiled with the instruments. In future I

intend to use Keller's catgut, rendered antiseptic by soaking for two weeks in ether, which extracts a few drops of oil from it, and then by soaking for two weeks in 1 in 200 sublimate alcohol, after which it is finally kept, until used, in absolute alcohol.

The asepsis of the patient is a precaution which gives to some operators a good deal of anxiety, but not to me. Whenever possible she is compelled to enter the hospital three days before the operation, and for three nights she has a hot bath, in which plenty of laundry soap is used. She is kept soaking in the bath for from twenty to thirty minutes each time, so as to remove all the dead skin, with its colonies of bacteria, leaving nothing but healthy living epidermis. The nurse gives special attention to the cleaning of the umbilicus. With the patient so prepared, with clean clothes and kept in a clean bed, I have very little anxiety about the cleansing of the field of operation; I merely scrub the abdomen with soap and brush, especially the navel, then shaving not only the pubic hair, but also the fine down, on the abdomen, rinsing the surface with 1 in 500 bichloride, and then with boiled water, so as to save my instruments, when she is ready. Two small precautions now will save much trouble. Many times have I seen the patient suddenly touch the field of operation at the first cut of the knife, when it was thought she was entirely under the anaesthetic. Therefore, her hands should always be wrapped in clean towels, and gently but firmly bound together with a strip of gauze. Many other times have I seen her suddenly raise her knees, scattering on the floor the pressure forceps, knives and scissors all laid out ready to the surgeon's hand; therefore, her knees should be firmly strapped to the table by a broad belt with a buckle, like a surcingle of a horse. Not only will this prevent her from moving, but in case of the necessity arising of placing her in the inverted position, on account of fainting, the assistants can perform the manœuvre by inverting the table without touching the patient. But before strapping down her legs, and immediately after placing her on the table and before the nurse has finally sterilized her hands, she should pass the catheter in the presence of the operator. I have once seen the full bladder cut into by a brilliant surgeon who had been assured that the patient had passed water just before being placed under the anaesthetic; and the same thing would once have happened to myself had I not begun my incision pretty high up and felt a fluctuating tumor on introducing my finger in the region of the bladder, when I stopped operations until a pint of urine had been withdrawn by the catheter. In this case the nurse had assured me that the patient had just previously emptied her bladder. Sometimes a great quantity of urine is secreted in a short time, and sometimes there is retention, so that it is safer to take no chances, but to see it done while the patient is on the table. By making the first incision half way between the umbilicus and pubes and only barely large

enough to introduce one finger, the bladder can surely be avoided, because one finger will act as a director on which the blade of the scissors can be passed, and the incision can be extended downwards as far as necessary or as may be safe.

A great deal of stress used to be laid upon the importance of finding the linea alba and of opening the abdomen exactly in the middle line. I have seen hundreds of precious seconds wasted in this search, which, even when successful, in no way increases the success of the operation. Indeed, it is probable that union is much firmer and more rapid when the knife goes cleanly through the rectus muscle. Care should be taken to cut through the peritoneum on a director, introduced through a tiny hole, which hole is made while the peritoneum is lifted up by the forceps on either side. I have seen some of the world's greatest surgeons cut through the intestine while opening the peritoneum, and I would have done the same thing several times in cases in which the intestines were glued to the abdominal wall, had I not taken the precaution of opening the peritoneum on a director. We now have it in our power to have mural abscesses or to obtain union by first intention, according to whether we employ pressure forceps to arrest hemorrhage from the abdominal incision, or whether we content ourselves with arresting hemorrhage by means of very hot compresses. If the vessels are large enough to spout, it is much better to cut them completely across and then to twist each end with a torsion forceps. I think this is much preferable to tying them, as the absorption of the catgut is so much unnecessary work for the phagocytes to perform. While infection of the wound will cause mural abscesses and stitch abscesses to follow, I believe they are most often due, in these days of rigorous aseptic precautions, to bruising of the structures, especially the delicate cellular tissue, with powerful pressure forceps, which are left on sometimes for a quarter of an hour or more; while stitch abscesses are more often due to sloughing, from too tightly tying the sutures. Some operators attribute mural abscesses to carrying infection from the upper layers of the skin into the deeper layers by means of the suture; and they therefore take all sorts of precautions to avoid this. In my last ten sections I have had union absolutely by first intention, with the exception of the drainage tube hole, which, of course, closed up by granulation; but even at that place there has hardly been more than one drop or two of moisture.

The next precaution for the prevention of sepsis is the keeping of the peritoneal cavity clean, or the cleaning of it if soiled. Some of the most rapidly fatal cases of septic peritonitis have been caused by the escape of a few drops of pus from an ovarian abscess. Some have even recommended the aspiration of pus tubes or ovarian abscesses in order to diminish this risk by rupture during removal. I have little fear of this, however, as I have over and over again ruptured the most

stinking abscesses, and their contents have inundated the peritoneal cavity, and yet the patients have made a splendid recovery. In such cases, and indeed in every case in which the peritoneum has been soiled in the slightest, one element of success, which is absolutely essential, is the washing out of the peritoneum with plain boiled water cooled down to 110° F. or 105° F.

I assisted a colleague in a distant town once at an easy operation of removing the uterus, containing a sloughing fibroid. A corkscrew was used to extract it from the woman, but the tissues were so soft that they would not hold, and the result was that the instrument slipped out, throwing some small pieces of necrosed matter among the intestines. We had forgotten the irrigator, which would have floated these pieces out; but although carefully sponged out, some of the minute particles must have remained in and infected the peritoneum, for the patient died three days later of septic peritonitis. Once the abdomen is closed and dressed in the way I shall mention, there is no more danger as far as infection is concerned. The patient's fate is sealed when the wound is sutured. Even when the drainage tube is employed under ordinary precautions, infection is not liable to occur. I employ one of the longest and narrowest tubes, with very tiny perforations in it, so that the intestines cannot get caught in them; this accident having happened to me, and a slight fecal fistula resulting in one case, in which the perforations of the tube were too large. The tube is pumped out frequently, by a bulb syringe with a long soft rubber nozzle, and the tube should be gently turned half round several times a day.

The kind of sutures appears to me to have much to do with the ultimate success. According to many, there is only one material suitable for the purpose, and that is silkworm gut, for as I shall show later on, abdominal sutures should be left in position for one month. Silkworm gut is as clean and strong at the end of that time as when it was first put in. The wound and stitch holes should be buried in half an inch thick of boracic acid, and they should not be seen again for a month, unless the first dressing has been soiled by the overflow of the drainage tube, in which case the soiled powder is removed and replaced by dry powder. Among the arguments used against the extra-peritoneal treatment of the stump after hysterectomy, we often hear that there is great danger of sepsis. This seems absurd to me, for with the stump buried in dry boracic acid powder and the peritoneum accurately closed around it by suture, and the abdominal incision also buried in dry boracic acid powder, it is impossible for the peritoneum to be infected thereby; moreover, as any one knows who has reopened the abdomen after an abdominal section, the peritoneal surfaces are glued together in a few hours, or probably in a few minutes even, after

the operation. As far as my own small experience goes, I have not lost a case from sepsis.

Avoidance of Hemorrhage.—From my own experience, and from inquiries above referred to, I find that the second great element of success is the securing of perfect haemostasis, for, after sepsis, hemorrhage seems to have been the principal cause of death following abdominal sections in the practice of a great many first-class operators, who have kindly replied to my question on the subject. Hemorrhage is either primary or secondary. Some have told me that they lost their patients from shock, but this term had better be discarded, and all those deaths formerly classed under that heading should be put down to either primary or secondary hemorrhage or to prolonged anaesthesia.

To begin with, my own case of death from hemorrhage was due to a tear in the very wide pedicle which was ligatured in segments, the tumor being so large that I was compelled to cut the pedicle as I proceeded with the ligating. The drainage tube revealed the fact that considerable hemorrhage was going on; and on reopening the abdomen, I found it coming from a tiny artery in the broad ligament, which had been opened by this tear, and which was below the line of ligatures. This death would not have happened if I had, after tying the pedicle in sections, followed these ligatures by another one *en masse*, low enough to have included the torn part. I easily caught up the bleeding point and tied it, but the patient had gone too far to stand the second operation. I have known several other deaths to have occurred from the slipping of a ligature, in the case of simple removal of the appendages. It seems difficult to understand how this accident can happen if the pedicle is transfixated with two ligatures, which are crossed, tied on each side, and the one tied last is again brought around the whole pedicle, tying it *en masse*. It is simply impossible for such a ligature to slip off. If stout catgut of good quality and properly prepared be employed, it is still safer than silk, for the reason that catgut when wet contracts. This can be demonstrated by a simple experiment of tying a piece of expanded laminaria digitata with silk and catgut, the one a short distance from the other, and then immersing it in water. The catgut will be found in an hour or two to cause a distinct constriction of the elastic material, while the silk ligature allows it to remain the same as when first applied; fine catgut sutures on large adhesions are necessary, but for oozing, irrigation with very hot water seems to control it effectually. I have many times expected a very profuse oozing, and indeed closed up the abdomen, after having placed in the drainage tube, with great misgivings, only to find that the total amount sucked from Douglas' cul-de-sac during the next twenty-four hours did not exceed half an ounce. When the intestines are torn, hemorrhage in them had better be stopped by Lembert sutures

rather than by the galvano-cautery, as, in one case in which I had occasion to perform a secondary operation a month later for removal of an abscess in the other ovary, I found that a spot on the intestine, which I had touched with the galvano-cautery in order to arrest the hemorrhage, had become firmly agglutinated to the surrounding coils, from which it was impossible to detach it. We may, I think, dismiss the introduction of astringents, such as perchloride of iron, as in every case in which I have heard of its being employed, the patient died from peritonitis. The pressure with sterilized gauze is safe and seems to have been without any marked bad effects. Undoubtedly, most of the hemorrhage is due to delayed operations, that is to say, operations put off too long, so that we may under the heading of delayed operations include not only most of the cases of deaths from hemorrhage, but also the deaths from prolonged anaesthesia, for it is precisely the dealing with adhesions and the arrest of the hemorrhage resulting from the tearing of them that makes the operation prolonged; while, on the other hand, the prolonged anaesthesia is itself a very important element in the unfavorable result. We have in the drainage tube a valuable sentinel to warn us of secondary hemorrhage, and for that reason alone I think it is important to continue its use. The objections to it are, of course, that it keeps open an avenue for the introduction of septic germs, and that it leaves a weak spot in the abdominal incision, which is apt to give rise to ventral hernia.

The first of these objections may be dismissed, for with ordinary precautions on the part of the nurse who has charge of the emptying of it, there is very little danger of infection through the tube. As a proof of this, I may state that I have had no death of a section at the Woman's Hospital from sepsis, although most of the abdominal sections were performed in the general operating room, and treated afterwards in the general wards of the hospital, and with equally good results with those treated in special rooms, although most of these cases had drainage tubes for the first day or two. Apart from that, the drainage tube is soon walled in from the rest of the abdominal cavity, as is seen in cases of fecal fistula in which faeces may come up through the track of the drainage tube, apparently passing among the intestinal coils without causing any inflammation of the peritoneum. While the objection that the drainage tube gives rise to ventral hernia may be overcome by the fact that granulation tissue, if supported for a sufficient length of time in the manner I shall presently indicate, is as strong as any other part of the abdominal wall.

Prolonged Anaesthesia.—We now come to the avoidance of deaths from prolonged anaesthesia, which, as I have already said, are often put down under the vague heading of shock. It is a well-known fact that skillful operators can be found who, having more endurance and dogged perseverance than judgment, will continue at an operation for as long

as four hours. This is more than human flesh and blood can stand, for every one of such cases of which I have had cognizance has died. When we remember the profound degree of narcosis necessary during the whole continuance of abdominal section, and that the delicate peritoneum is being roughly handled most of that time, we can hardly expect that the result will be otherwise than fatal; so that it has become pretty generally understood that one of the most important elements of success is speedy operating. We find that those who have death rates of three to five per cent. are operators of great skill and experience, who have reduced the time for a given operation minute by minute, until what would take an unskillful operator an hour, perhaps they can do in twenty minutes. One might almost formulate the rule that any abdominal operation which is going to require profound anaesthesia for more than an hour had better not be done at all, or had better be stopped when the hour is up.

I never had occasion more than once to admire the judgment of celebrated operators, who, in the presence of adhesions which it was impossible to detach within an hour, had the courage to stop the operation and save the patient's life; while more than once I have felt sorry to see what would otherwise have been a fairly successful operation turned into an inevitably fatal one in the hopeless endeavor to make it perfect at the expense of the patient's life. Any saving in time, therefore, which can be attained through skill in technique and strict attention to business, contributes greatly to the success of the results; and for this reason conversation or anything else on the part of visitors and assistants which would take up a single moment of the operator's attention or distract it from the work he has on hand, or even the delivering of a practical lecture during the course of an abdominal operation is to be deprecated, for there are few people who, like Julius Caesar, can do seven things at once; and while they are telling a story or listening to a joke or delivering a lecture, they are losing at least a few precious moments, and add so much to the risks from prolonged anaesthesia. When the patient's abdomen is sewed up, and the anaesthetic discontinued, then and not till then should a single word be uttered.

The Care of the Intestines.—The fourth element of success is the care of the intestines, the most important point in which is, in the words of one of America's most celebrated operators, that one should never see them; and I have many times tested the truth of his proverb. If I do not see the intestines once during the operation I feel very little anxiety about their management afterwards; while if the intestines are seen during the operation, or still more so if they escape from the abdomen and are laid out on the abdominal wall or on the table, no matter how they are protected with hot towels or oiled silk, I know that there will be great trouble in managing them afterwards. Whether this is due to paralysis of the great sympathetic nerve by exposure to

the air or to injury to the peritoneum from over much handling, it is a well-known fact that intestines which have been handled a great deal give a great deal of trouble, and cause a great deal of anxiety afterwards. Although deaths from interference with the functions of the bowels are not so common as those from sepsis or hemorrhage or prolonged anaesthesia, yet quite a few operators have told me that they have lost cases from this cause. Many of them have even re-opened the abdomen several days later, and found the obstruction and saved their patient; but in many other cases the intestines absolutely refused to act. It will generally be found that where the intestines have been subjected to handling, either outside of the abdomen, or even to a great deal of sponging in the abdominal cavity, there will be some tympanic distension and paralysis afterwards; while if no sponging be employed, and the abdominal cavity cleansed by means of hot water irrigation, the intestines act naturally in a day or two after the operation. This is a strong argument in favor of irrigation instead of sponging, for the cleansing of the peritoneum. Not only is sponging, as I have already said, an inefficient means of removing every particle of aseptic matter, but also if some of the water be left to float in, the lymph which exuded out from the raw surfaces is diluted so much that it fails to act as a glue or cement to bind the coils of intestines together. For this reason it seems to me that it would be well in every case to leave a little water in the peritoneum, which is quite able to absorb it, when it is no longer required for this purpose, if it does not flow out, as I have generally found it to do, by the drainage tube. In some desperate cases of abdominal distension, when everything else has failed to relieve the tympanitis, I have been indebted to Professor Skene's prescription, which I think should be generally known, which is as follows: Six or eight grains of quinine dissolved in aromatic sulphuric acid, with about half an ounce of water, with acacia enough to make the mixture bland; is administered by enema. When about to administer it, warm water enough is added to raise the temperature of the mixture to that of the rectum. This, he says, he has found will relieve flatulence if it can be relieved at all, and is at the same time a good way of supporting the patient; in fact, he thinks its action in relieving flatulence is by restoring the tone of the intestine. Rather than allow the patient to die from obstruction of the bowel, we of course must reopen the abdomen. In one case I know of this having been done, and the patient's life saved, the intestine having been found adherent to the abdominal incision. This, of course, could be prevented by drawing the omentum down over the bowels, before closing the incision.

Other Elements of Success.—In addition to the elements of success which are necessary for the avoidance of the above four principal causes of death, there are other minor accidents which must be avoided if we wish the cases to be successful. Thus we can hardly call the

result satisfactory if, in the place of an aching ovary, we leave a painful ventral hernia. A few words, therefore, on the prevention of ventral hernia may be opportune. When the edges of the abdominal incision are brought together clean and not bruised, and with corresponding layers of tissue in exact apposition, we obtain union by first intention. Under this term we may include all cases of union in which there is no suppuration or granulation, although it does not necessarily follow that there is an exudation of plastic lymph. The ideal union by first intention is, of course, one in which the cut openings of vessels and the cut fibres of other tissues exactly correspond and unite; but this probably never occurs after an abdominal section. The union is rather due to the exudation of plastic lymph from the opposite surfaces, which forms a gelatinous glue and which eventually becomes organized into white fibrous tissue. We can obtain a good idea of this process by observing what takes place when the tendon Achilles is cut by the orthopedic surgeon, for the cure of talipes equinus. After the subcutaneous division of the tendon, the foot is kept for three days in its former faulty position, so that the divided ends of the tendon shall become joined again by the fusion of plastic lymph. When a sufficient quantity of this has exuded, and while still in a soft and stretchable condition the surgeon gradually brings the foot to right angles with the leg, until there is perhaps a space of two inches between the cut ends of the tendon, which are united, however, by this band of soft plastic lymph. The foot is then left in position until this material has become thoroughly organized, when the patient will be found to have full use of the part. The same thing, I take it, occurs after an abdominal section, and it is owing to the too early removal of the suture while the plastic lymph is still soft and stretchable, and before it has become organized into white fibrous tissue, that we owe the great frequency of ventral hernia. By leaving in the supporting silkworm gut sutures for one month after the operation, we can avoid not only the risk of ventral hernia, but we are also saved the anxiety of the incision being torn open during a fit of coughing or other effort, and the intestines escaping out of the abdomen, as has occurred in several recorded cases. If the silkworm gut sutures are left in for a month, as I have done in my last fifteen or eighteen cases, they can do no harm, and this accident is absolutely prevented from occurring, although I am not positive as to the exact time it requires for conversion of this plastic lymph into dense white fibrous tissue, yet I will be in favor of leaving in the sutures at least until this process has had time to be completed. In my last few cases I have been introducing a few buried silkworm gut sutures through the cut edges of the abdominal fascia, which of course remain during the whole of the patient's life, and which therefore render the occurrence of ventral hernia impossible. These were introduced after the through and through sutures had been placed in position, and before the latter were tied.

We may, therefore, sum up the elements of success in cœliotomy, as far as we know them at the present time, in the avoidance of sepsis or peritonitis, the avoidance of hemorrhage, the avoidance of prolonged anaesthesia, the avoidance of injury to the bowels and bladder and the avoidance of ventral hernia and mural abscesses. From the experience of a great number of operators, we may infer that if we lost no patients from any of these causes we could do a thousand abdominal sections as well as a hundred without a death.